# The Right Time for Makerspaces in Nigerian Academic Libraries: Perceived Benefits and Challenges

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#### ABSTRACT

The present study investigates makerspaces in Nigerian academic libraries: perceived benefits and challenges. Four objectives guided the study: what constituted makerspace in academic library, the level of awareness of makerspace by academic library benefits and challenges of adopting makerspace in libraries. The descriptive survey design was adopted and questionnaire was used for data collection. The population of the study comprised of professional and paraprofessional librarians of Ambrose University and University of Benin, from which a sample size of 119 was drawn using total enumeration sampling technique. Out of the 119 copies of questionnaire administered, 94 were retrieved and analyzed using simple percentage and frequency tables. Findings revealed that, the respondents were aware of what constitute makerspace which are library space, 3D printers, computers and projector. It was also discovered that, the respondents had a high level of awareness of makerspace in the library. Some of the benefits associated with the use of makerspace are: it facilitates group interaction, it improves knowledge and provides access to wide varieties of tools and technology. Some of the challenges encountered in the adoption of makerspace are training of academic library staff, security of makerspace gadgets, poor funding, erratic power supply, high cost and maintenance of equipment. It was however recommended that; librarians should make deliberate effort to explore the potentials in makerspace in the enhancement of their services and training should be conducted regularly to enhance librarian's skills in the use of ICTs.

Key words: Adaption, Awareness, Makerspace, academic Library. Makerspace in libraries

## 1. Introduction

Technology has affected every sphere of life whereby people are moving from the paradigm of buying everything they need to making those things themselves. This competing world is leading to a special focus on the patron as a customer that needs to be satisfied. New services are emerging, and innovative means of offering online information resources are being created. All of these efforts are to ensure the survival, and sustainability of the academic library. On the other hand, diverse information resources, printed, or online are still needed, and used by librarians, and faculty members.

Libraries have keyed into most of these developments by involving in every emergent technology as noted by (Massis, 2014), that librarians are always on the cutting edge of the latest, newest, most high-tech service delivery models, and that is why "makerspace in libraries" seems very much top of mind. Makerspaces are rapidly growing in popularity as a unique way for libraries of all types to serve their users (Robinson, 2015). Although a nascent technology, the place of makerspace in libraries cannot be overemphasized; it draws users to the library and promotes collaboration among learners. The advent of makerspace technology promises to pave way for unlimited proliferation of knowledge and new ideas among scholars. The tide of this technology is gradually spreading globally and libraries are getting involved in this trend by advocating makerspace in libraries. As reported by Colegrove (2013), a number of libraries across the country have been actively expanding makerspace within the physical library and exploring its impact.

Balas (2012) and Britton (2012), cited in Pryor (2014) remarked that makerspaces in libraries are definitely a trending topic in library discussion and literature, but much of the attention in this area has focused on public libraries. In the same vein, Boyle, et al (2014) added that 'the establishment of creative spaces (any place where the community can come together for informal and shared social learning) in public libraries has been an emerging trend worldwide in recent years'. The purpose of the makerspace is to create a comfortable environment for users to experiment, create and learn within a controlled setting. Makerspaces enable students and faculty members to apply scientific principles and meet curricular science through the design, creation

and building of products. Makerspaces may include 3D printers to produce three dimensional products such as toys and robots, tools. 101' welding or building, software for the production of music as well as craft and art supplies (Fernandez, 2014).

Chan and Spodick (2014) attested that 'most of these early makerspaces are in public Libraries'. This is also evident in the web-based survey whereby 51% of respondents were in public libraries, 36% in academic libraries, and 9% were in school libraries. Nevertheless, it has become a recent development in academic libraries as well. Libraries provide resources for not only consuming information, but also for generating new information and research. Creation tools are traditionally provided in departmental labs and faculties but with the invention of makerspaces, libraries tend to support learning by adopting the trend of creating an enabling environment for critical thinking and experimentation.

Russell and Tierney (2008) advocate the need for information professionals to adopt, support and nourish change and innovation in libraries. Turner, Welch and Reynolds (2013) added that 'one of the changes occurring in academic libraries is the use of space to support both the library's activities and the mandate of its parent body, sometimes in competition with other stakeholders in the academy'. This in turn, creates the opportunity for libraries to market their products and services due to the increased number of visitors to the library. Makerspace is just a space created in the library, by the library management to enable researchers share ideas and collaborate.

Makerspace is 'a physical location embedded to share resources and knowledge, work on, network, projects by different people from different academic background' (Wong and Partridge, 2016). It is a hub to create, invent, tinker, explore and discover using a variety of tools and materials to develop certain skills. It may be pronounced as a community center that provides technology, manufacturing equipment and educational opportunities to the public; things accessible or unaffordable such as 3-D printers, and computer-aided design (CAD) software. Makerspaces have been defined differently by different people. The goal of makerspaces aims at reducing barriers so that people can learn and start creating their resources and collections.

According to Wong, (2013) makerspaces are, "places that help cultivate creative interests, imagination, and passion by allowing participants to draw upon multiple intelligences. They are an effective means of applying knowledge, and they tap new resources for learning. Makerspaces embrace tinkering, or playing, in various forms of exploration, experimentation and engagement, and foster peer interactions as well as the interests of a collective team (Wong, 2013). "They allow free exchange of ideas and resources through exploration, experimentation, engagement and interactions of peer groups.

Creative spaces are not directly related to any specific tool or set up, sponsored organization or publication. They embrace any space that renders innovative learning equally devoid of tools/equipment, and allocated space. This study is an effort to understand makerspaces in Nigerian academic libraries: perceived benefits and challenges.

# 2. Statement of the Problem

Makerspace is said to be a physical location embedded to share resources and knowledge, work on, network, projects by different people from different academic backgrounds. Unfortunately, these services may not have been provided as required by libraries, which the researcher observed may be as a result of inadequate awareness and adoption of makerspace.

However, it has been discovered that no relevant literature suggests makerspace awareness level, adoption, benefits and challenges in academic libraries in Nigeria. This gap in knowledge is what the current research is trying to fill. In Edo State libraries, laboratories exist in various departments but 'makerspace' is not common within libraries in Edo State. It is against this background that the researcher intends to investigate makerspaces in Nigerian academic libraries: perceived benefits and challenges.

## **Objective of the Study**

The major objective of this study is makerspaces in Nigerian academic libraries: perceived benefits and challenges.

The specific objectives of the study are to:

- i. determine what constitutes makerspace in academic libraries in Edo State;
- ii. ascertain the level of awareness of makerspace by academic libraries in Edo State;
- iii. find out the benefits of makerspace to academic libraries in Edo State and;
- iv. determine the challenges encountered in the adoption of makerspace in academic libraries in Edo State.

## 3. LITERATURE REVIEW

#### **Concept of Makerspace in Library**

Space is one of the most valuable assets a library possesses (Chan and Spodick, 2014). The paradigm shift in information resources from print to electronic and services from manual to electronics, calls for critical examination of the concepts, principles and features of library as space and place (Ugwuanyi, et al.). In recent years, university libraries have taken a more strategic approach to space planning and use (Matthews and Walton, 2014). One key concept according to Benneth, et al. (2005), is that 'the library as a place must be self-organizing--that is, sufficiently flexible to meet changing space needs. To accomplish this, library planners

must be more entrepreneurial in outlook, periodically evaluating the effective use of space and assessing new placements of services and configurations of learning spaces in response to changes in user demand'. Childs et al. (2013) found that in the 1970s, 'lack of space for growing book and journal collections was a common concern, with little attention paid to how users might use its space in future'. Meanwhile, in an earlier study conducted by Childs (2011), 'moving into the 1980s, there was recognition of the way technology may affect libraries, but with little focus on space and learning and research'. Association of College and Research Libraries (2010) noted that 'in recent years, university libraries have taken a more strategic approach to space planning and use'. As posted by Burk (2015) in 'Library Planning Research, Space Planning', 'The library can show a better return on investment for digital knowledge resources by offering different types of learning spaces.' Learning space fosters sharing of ideas, in order to find solution to pressing issues or finding answers to questions thrown up in a group discussion. Learning environment in libraries have gone beyond solitary engagement to collaborative engagement. Academic libraries are essential to the core mission of colleges and universities across the nation (Soria, Fransen and Nackerud, 2013). The language of library space is such that the Burk (2015) found during their library studies, that 'all libraries need environments that allow for social, group and individual study. The library plan should include:

- a) active space -information commons, learning commons, group collaboration, etc.
- b) quiet space- contemplative space for study'. A space for study should enhance sharing of ideas for teaching, learning and research.

Makerspace is an enabling environment that enhances this sharing of ideas among individuals. It is a technology-enabled space for making things or environment where individuals come together to share knowledge and ideas. Makerspace is a nascent technology in libraries which is geared towards facilitating group learning. Anderson in Burke (2015), reported that 'the rise of makerspaces as a concept began around 2005 with the beginning of Make: magazine and its promotion of creative projects and methods for making'. The findings of the study carried out by Moorefield-Lang (2015) revealed that 'the implementation of a maker learning space is still new to many libraries'. Users in libraries are not used to a kind of space for working on tools together; rather they could read together and exchange ideas. The advent of makerspace has enabled individuals incubate ideas and share it with others. Makerspace is a conducive environment where people are able to design products from zero to existence a place designed to 'democratize the act of making something from scratch' (Cavalcanti, 2013). The Library as Incubator Project (2013) defined makerspace as 'collaborative learning environments where people come together to share materials and learn new skills.' This terminology was described by Turner, Welch and Reynolds (2013) as a very recent occurrence which is only beginning to appear in the literature but provides further evidence of the evolutionary nature of library space in terms of both usage and the language employed to define it. The Library Director of Miami University Middletown (John Burke) termed makerspaces as 'a growing service area for many libraries in school, public, and academic, MM settings'. Makerspaces are not defined by a specific set of materials or spaces, but rather a mindset of community partnerships, collaboration, and creation (The Library as Incubator Project, 2013).

So far the emphasis on makerspace has been on creating, usually with some kind of technology (Abram, 2013). This has led Bagley (2014) to define Makerspace as a space designed to allow users to create, build and learn new projects and technologies. Makerspaces tend to engage users and build their level of literacies across multiple domains and the library serves as a centre for such activities as buttressed by Colegrove (2013) who stated that 'one might even suspect that to some degree, libraries have long been makerspaces'. Libraries are gathering, meeting, and collaborating in spaces within the context of shared community and shared learning resources, which aligns well with library collection, staff, and space strengths and competencies and with the makerspace concept, it is perfectly aligned with the library's role in neighborhood and educational settings (Abram, 2013).

## Level of Awareness of makerspace

Users in libraries are not used to a kind of space for working on tools together; rather they could read together and exchange ideas. The advent of makerspace has enabled individuals incubate ideas and share it with others. Makerspace is a conducive environment where people are able to design products from zero to existence a place designed to 'democratize the act of making something from scratch' (Cavalcanti, 2013) The Library as Incubator Project (2013) defined makerspace as 'collaborative learning environments where people come together to share materials and learn new skills.' This terminology was described by Turner, Welch and Reynolds (2013) as a very recent occurrence which is only beginning to appear in the literature but provides further evidence of the evolutionary nature of library space in terms of both usage and the language employed to define it. The Library Director of Miami University Middletown (John Burke) termed makerspaces as 'a growing service area for many libraries in school, public, and academic. Makerspaces are not defined by a specific set of materials or spaces, but rather a mindset of community partnerships, collaboration, and creation (The Library as Incubator Project, 2013).

Burke (2015) reported that Staff at the Odom Library created a makerspace by repurposing an unused room to give students a place to work on digital media projects. The makerspace was equipped by library staff members who repurposed surplus equipment from the campus' IT department, surplus furniture from elsewhere in the university, and by gaining internal grants to buy 3D printers. Library staff members offer regular workshops to teach students how to use the technologies or complete their projects independently.

University of Pretoria: South Africa has recently joined the hype of makerspace in libraries as the University of Pretoria recently democratized making things by opening a makerspace in the library. The official opening of the library makerspace took place on 30<sup>th</sup> March, 2015. As reported on the University of Pretoria News page on April 13 2015, The Department of Library Services at the University of Pretoria (UP) became the first library in South Africa to open a Library makerspace.

Burke (2013) reported that the library makerspace at the College of San MateoSan Mateo began as an attempt to serve students in a new way. Becoming more aware of users' needs is a great way of improving academic library services. Users who initially had not been exposed to new technologies such as 3D-printers and scanners may have the opportunity of getting to explore these new technologies as they visit the library makerspace. Some technologies would have been off-limits to users but with the makerspace in place, users can have equitable access to them (Britten, 2012). The technologies also contribute to providing a new space for users to participate in new learning opportunities (Slatter and Howard, 2013). Southern New Hampshire University's Shapiro Library, the experience of developing a makerspace and offering these services has been highly rewarding ~ several students, faculty members, and staffers are learning new things, working with their peers, considering new ideas, exploring, tinkering, inventing, and making (Ham's and Cooper, 2015). Makerspaces are not popular, or well known in the Middle East. There are rare if non research papers about makerspaces in the rejoin. This research paper has a new orientation, studying students who are not aware of what maker-spaces mean. Undergraduate students in Kuwait University will be surveyed, investigating their perception about having maker-spaces in academic libraries.

Galaleladin, Bouchard, Anis, and Lague (2016) also studied the impact of makerspaces on Engineering. They interviewed the students, and the results upon the role of makerspaces were positive. Maker-space affects the skills of communication, team work, problem solving, problem investigation, and design positively.

Hussain and Nisha (2017) carried a study on the benefits and level of awareness of maker-spaces the results showed that high numbers of the sample that are using makerspaces are perusing a master's degree. 68% of the sample surveyed used maker-spaces for academic research purposes. All most all of the surveyed participants appraised libraries) maker-spaces as beneficial. Burke (2015) stated that maker-spaces in academic libraries may provide learning skills, co-working and collaboration between peers, curriculum support, and the acceptance of the idea of sharing, and exchanging information.

## Makerspace adoption by academic libraries

Many libraries are embracing the maker movement as an exciting new community to welcome into their doors by creating new spaces, adding new services and technologies, and offering new types of programming at the North Carolina State University Libraries, we have been inspired by the maker world, with its enthusiasm for creativity and interest-driven learning and its focus on open source, easy-to-learn, and powerfully flexible technology platforms. We have formed a makerspace program, with two dedicated spaces and a variety of technologies available for our users to borrow. The NCSU libraries and Spakfun Electronics, Inc have partnered to explore challenges and creative solutions to integrating maker technologies into libraries as well as ways to support student learning goals with both library led workshops and course integrations.

Having long been the center of information and knowledge, the library is an ideal destination for projects to blossom (Preddy 2013). Librarians continually search for ways to engage students in thinking, creating, sharing, and growing; therefore, the partnership of the science educator and librarian to encourage these skills is quite powerful. A makerspace is an ideal place to incorporate more STEM activities into a fun and inspiring environment beyond the constraints of a traditional classroom setting. Because academic libraries already nurture critical thinking and learning, they are a perfect environment for makerspaces

Librarians can help faculty develop new assignment types that both connect to the disciplinary content and encourage students to experiment with new media. In many cases, faculty are open to thinking about such assignments if they are not solely responsible for the technical aspects of its implementation and the associated risks (Lippincott, Vedantham, &Duckett, 2014). For example, the librarian, as an information specialist, possesses the knowledge and expertise to guide budding scientists to the right DIY instructions and information through library sources such as virtual databases, informative websites and credible journals. However, collaborating with trained STEM/STEAM educators, technology faculty and library staff may provide new opportunities by combining their shared skill set and expertise. Science educators and librarians can create a partnership to develop spaces for probable heightened collaboration, enhanced mutual respect and the achievement of common professional goals (Augustin, 2014).

## The Role of Makerspace in Academic Libraries.

Findings show that the interest in makerspaces in libraries has been growing over the last decade, particularly in the USA where makerspaces can be found in public, special and academic libraries. The choice of the library as a physical space for a makerspace is based on the historical role of the library as a shared space with shared resources. The new technologies serve as a catalyst for a new model of community resource, i.e. the makerspace (Britton, 2012; Harris & Cooper, 2015).

A large part of the literature on the subject is about specific cases and the experiences of librarians running makerspaces in academic libraries. A common trend is that the makerspace provides an answer to the need of the library to evolve and adapt by meeting the needs of their communities through the provision of access to tools unavailable elsewhere.

(Britton, 2012). The makerspace has been seen as enabling librarians to better serve their communities and extend the libraries' purpose by offering solutions to current requests (Harris & (Deeper, 2015), changing libraries into learning commons (Kompar, 2015).

Learning commons were a driving force behind a two-year programme of reimagining the library, which included setting up makerspaces in academic libraries (Kompar, 2015). As Kompar(2015) notes:

A learning commons is a philosophical and paradigm shift that incorporates and supports academic and district-wide initiatives, such as the implementation of digital learning. . . .inclusive of a rich integrated, digital and media literacy curriculum, 24/7 access to collaborative media engaging the users in participatory digital spaces; and flexible usercentred, creative physical spaces. The transformation of the traditional academic library into learning commons provides relevant resources in a variety of formats and expertise on incorporating research/information fluency and media and digital literacy.

The experience of transforming the library space into a common space offering collaborative activities has been successful as it has turned setbacks and losses into positive results, with increases in the circulation of books and collaborative instruction with teachers (Kompar, 2015).

Smay and Walker (2015) suggest that the experience gained from setting up a makerspace in a academic library shows that it may intrigue students who want to explore unfamiliar technology. The makerspace can also open up new collaborations between staff. The challenge of the makerspace within an academic library has been to find out how to support the curricula of all age groups and embed them into the makerspace. Smay & Walker (2015) argue that experience has shown that the makerspace can offer a blended model of support for all age groups by being a resource for the independent student, and a support to classrooms, offering 'different ways for students to demonstrate their knowledge through different formats or media'. They have also helped teachers design their own teaching models and tools Makerspaces have offered possibilities for all age groups to develop projects according to their needs, with adapted methods to capture their interest and keep it. Choosing the library as a place for the makerspace has encouraged collaborations between teachers across curricula and subjects. Instead of being confined to their classrooms or specific labs, teachers meet other teachers in academic-library based makerspaces. Another benefit found is that assignments set in makerspaces engage students in work that challenges them to be curious and open-minded (Smay& Walker, 2015). It is generally held that the makerspace fosters creativity, innovation and exploration by helping students to acquire new skills, and by offering support and expertise (Smay& Walker, 2015; Harris & Cooper, 2015). This type of activity has been seen as a catalyst for a mindset that should help students to develop a positive approach to life-long learning (Smay& Walker, 2015). The number of makerspaces in libraries has increased in recent years, but they still need to justify their existence. Libraries have learned from running makerspaces that it takes time and patience to find out how to use the tools, especially 3D printers, but also other equipment. Maintenance and fixing equipment also takes time (Harris & Cooper, 2015).

Thus, libraries are challenged to sustain their makerspaces by articulating their vision for the future and their purpose in having a makerspace. In a review of public discourse related to makerspaces in libraries, undertaken by analysing relevant publications, including journal articles and blogs, Willett (2016) identifies a series of tensions and contradictions in the literature. She argues that:

...polarized accounts present in the data set position formal educational content, styles, and pedagogies in negative ways and oversimplify the distinctions between formal and informal learning settings. This raises questions about how makerspaces engage in a range of styles of teaching and learning and who might benefit or be excluded from different teaching styles. As the makerspace movement in public libraries progresses, these tensions and questions potentially offer space for dialogue about aims, purposes, and best practices in relation to making and makers (Willett, 2016) In the years ahead, it will be important for research on makerspaces in libraries to address some of these issues, in addition to identifying the way in which such spaces can be maintained in the light of significant cuts in public funding for libraries in many countries.

## The Library is a center for innovation

The library should serve as innovative spaces (Chan and Spodick, 2014) with the makerspace situating in the library as a center for innovation where users are provided with a conducive and sophisticated environment for learning and collaboration. Burke (2013) reported that the library makerspace at the College of San MateoSan Mateo began as an attempt to serve students in a new way. Becoming more aware of users' needs is a great way of improving academic library services. Users' needs may change imperceptibly over time and libraries must constantly take such changes into account (Harbo and Hansen, 2012). American Library Association San Francisco annual conference and exhibition was held June 25-30, 2015 with the theme as 'public library as a center for innovation'. The conference was organized in attempt to redefine libraries as centers for innovation where spaces are created for users to support learning in digital literacy, visual literacy, cultural literacy, and spark innovation at every level.

## The library as a place for knowledge creation

The library's role in knowledge creation and STEM (science, technology, engineering, and math) education further endorses the library as a place for makerspace. The library supports teaching, learning and research and also creates an enabling environment for innovations and inventions. Every other department in a university may have their laboratories but a makerspace brings people from all fields together, and the library

being the heartbeat of the University can only serve as a central place for all. The 'it's just a trend' argument should not be used to hold off on implementing a makerspace (Bagley, 2014), otherwise it will hold no water to the University Administration when proposing a makerspace in an academic institution. In a web survey conducted by Burke (2013), Librarians reported that training sessions, workshops, or classes in their makerspaces were taught by library staff (49° 0), volunteers (27%), paid instructors from beyond the library (13%), others (12%), which includes; (IT staff, maker group members, Student Geek Force, and center for teaching and learning). This establishes that librarians are in the forefront of makerspace technologies in academic institutions.

## Benefits of Makerspace to Academic Libraries

Opportunities are needed by people to create, hack, and remake their world for the better (Britton, 2012) for which purpose, makerspace is a well suited platform, as it has been identified to give people the ability to create local solutions to local problems (Gershenfeld, 2005). According to Abram (2013), makerspaces are designed to meet the following needs:

- Provide access to a wide variety of tools and technology;
- Facilitate group interaction, knowledge, and resource sharing;
- >Supply access to physical space for individual project development;
- Provide an open environment for expression of creativity and innovation;
- Access to equipment for prototyping project ideas for companies.

Boyle, et al (2014) further summarized that: There are many clear benefits to both libraries and their communities from having a creative pace. These include empowering your community, fostering community collaboration and iii-creation, growing a larger, more engaged user base, enabling inter-generational learning and social connectedness, facilitating trans-literacy, developing a culture of lifelong learning and adding socioeconomic advantage to communities. Creative spaces also provide an opportunity for libraries to future-proof themselves and adapt to meet the changing nature of society

## **Makerspaces are Learner-Centered Opportunities**

As Martinez and Stager (2013) argue, "Makerspace is a stance that puts the learner at the center of the educational process and creates opportunities that students may never have encountered themselves. In a maker classroom or library, the teacher acts as a mentor and at times as a learner himself, as students are enabled to bring their own skills and ideas to the forefront. According to Kurti, Kurti and Fleming (2014), makerspaces encourage independent exploration and "owning the learning experience opens unexplored horizons to students because independent thinkers have the uncanny ability to strike out into uncharted territory". Makerspaces provide flexible learning arrangements that promote both autonomy and collaboration, enabling students to test out their own ideas and innovations.

Makerspaces Offer Authentic Learning Experiences Connected to the Real World Authentic, real-world experiences engage children, enabling them to see beyond their own context to understand the applications of what they are learning and doing. Maker learning is designed to provide such authentic experiences. As Martinez and Stager (2014) report, "Makers are constructing knowledge as they build physical artifacts that have real-world value" enabling kids to "solve real problems with their own inventions". Fleming (2015) also addresses the networked, outside-of-the-four-walls nature of makerspace learning, arguing that makerspaces "offer far wider spheres of communication and enables a critical mass of learning to be achieved globally rather than necessarily locally". Finally, Burke (2014) describes an example of a high school chemistry class maker activity, where students were studying ions and designing 3-D models of molecules. Burke (2014) reports that the maker activity portion of the learning "makes it more interesting and gives them [the students] a chance to learn new software, which they will have to do later in life. It has real-world connection for students beyond what they are learning in chemistry".

#### **Makerspaces Help to Prepare Students for the Future**

By providing opportunities in entrepreneurialism, exposing students to new skills and technologies and opening doors to new career paths, makerspaces can help to prepare student for the future and ignite a passion for lifelong learning. Martinez and Stager (2013) argue that making exposes young learners to engineering skills which provides a helpful context for some of the more abstract concepts in math or science. Furthermore, "for older students, making combines disciplines in ways that enhance the learning process for diverse student populations and Opens doors to unforeseen career paths" (Martinez & Stager, 2013). Fleming (2015) further expounds on the valuable characteristics encouraged by maker teaming, such as the development of a growth mindset and a toleration for risk and failure, arguing that "failure is a necessary step on the road to success and innovation". Finally, as Kalil (2010) reports, "The maker mindset empowers people not just to seek out jobs in STEM or creative fields, but to make their own jobs and industries, depending on their interests and the emerging needs they see in a rapidly changing society" (Pepplar& Bender, 2013).

#### Challenges Encountered In The Adoption of Makerspace In Academic Libraries.

The introduction of any form of technology in developing countries' libraries has always been faced with challenges (Nok, 2006) most of which would in turn; affect the makerspace technology in libraries. Some of these include:

# The challenge of training the users:

It may take time before the users master the terminologies and intricacies of the makerspace. 3D technology in particular, is not an easy one to master; it may take longer time than expected for the users to master. Learning the ins and outs of 3D printers and other equipment takes a lot of time and patience (Harris and Cooper, 2015). With this in mind, the makerspace manager ought to learn to be patient with the users and allow for more learning time.

# Security challenges

Safeguarding the equipments in the makerspace is very crucial and it becomes paramount that more security personnel are deployed to the library for this purpose to avoid stealing of objects.

## **Funding Issues:**

Poor funding is a major challenge to libraries in Nigeria (Nok, 2006).

## Lack of sufficient space in the library building:

Space is one of the most valuable assets a library possesses (Chan and Spodick, 2014). The university library physical space has an important role in learning, teaching and research, despite the increase in digital information provision (Matthews and Walton, 2014).

## **Erratic power supply**

Nigeria is yet to be named among the African countries that have celebrated one whole year of uninterrupted power supply as regular power generation remains a problem in Nigeria. Frequent power outages constitute a serious bottleneck to automation. The cost of running generating plants is prohibitive (Nok, 2006). Quite a lot of money is being invested in higher institutions to find alternative power supply. In a study conducted by Krubu and Osawaru (2011), it was ascertained that poor funding and erratic power supply are the major factors acting as a drawback or an impediment to the application of ICT in Nigerian University Libraries.

#### **Technophobia**

It is common knowledge that older librarians are the ones that suffer more from teclmophobia. The younger librarians are becoming more technology savvy than ever. But the underlying factor is that the older librarians form a greater population in most university libraries in Nigeria and with their fear for modern technologies in libraries, this may affect the establishment of makerspace in libraries.

# High cost and maintenance of equipment, Internet bandwidth, hardware and software

The librarian has always worked with less and done more, it often comes down to a simple lack of resources that prevents the librarian and the library from innovating at an even higher level (Massis, 2014). When the required resources are seemingly off-limits for libraries, makerspace can seem to be an expensive indulgence (Slatter and Howard, 2013).

#### 4. RESEARCH METHOD

The research design is a survey research design that intends to gather data from members of the selected population in order to determine the current status of the issue understudy from the respective institutions. The choice of survey as the research design for this project was necessitated by the nature of the study. The population for this study comprises all professional and para-professional staff in John Harris Library (UNIBEN) (Federal University) and Ambrose Alli University (AAU) (State University). Below is a catalogue of the population.

| S/N | Institution   | Location       | Professional | Para         | Total |
|-----|---------------|----------------|--------------|--------------|-------|
|     |               |                | Librarian    | professional |       |
|     | Ambrose Alli  | Ekpoma         | 11           | 36           | 47    |
|     | University    |                |              |              |       |
|     | University of | Benin          | 10           | 62           | 72    |
|     | Benin         | City Edo State |              |              |       |
|     | Sum Total     |                |              |              | 119   |

A sample size of the 119 was used for the study making it a total enumeration sampling techniques. This sampling technique was found worthy based on the fact that the population was manageable. The main instrument used for this research was a questionnaire method. The choice of this instrument was prompted by its ability to generate reliable and valid answers. The questionnaire used in this study was divided into section A G.

Section A: Personal data of the Respondents

Section B: Determine what constitutes makerspace in academic libraries in Edo State;

Section C: Ascertain the level of awareness of makerspace by academic libraries in Edo State;

**Section D:** find out the benefits of makerspace to academic libraries in Edo State and;

**Section E:** determine the challenges encountered in the adoption of makerspace in academic libraries in Edo State.

A total of one hundred nineteen (119) copies of questionnaire were administered to the librarians of Ambrose Alli University (AAU) and University of Benin (UNIBEN). The methods of data analysis used in this paper were simple percentages and tables, because tables help the researcher to see the similarity and relationships in the generated data set. In this research the raw data generated were converted to percentage and tabulated. The responses were analyzed according to their relevance to the research questions.

#### 5. RESULTS

This chapter presents the findings and analysis of data. A total of one hundred and nineteen (119) copies of questionnaires were distributed for this study, ninety four (94) (79%) questionnaires were retrieved.

## **Research Question One:**

What constitutes makerspace in academic libraries in Edo State?

Table1 constituents of makerspace in academic libraries

| S/N | ITEMS            | SA        | A         | D         | SD        |
|-----|------------------|-----------|-----------|-----------|-----------|
| 1   | Library space    | 12(12.7%) | 8287.2%)  |           |           |
| 2   | 3D printer       | 4(4.2%)   | 80(85.1%) | 10(10.6%) |           |
| 3   | 3D Scanner       | 17(17%)   | 70(74.4)  | 8(8.5%)   |           |
| 4   | Software         | 9(9.5%)   | 84(89.3)  | 1(1%)     |           |
| 5   | Computer (s)     | 30(31.95) | 74(78.7%) |           |           |
| 6   | Furniture        | 4(4.2%)   | 80(85.1%) | 1(1%)     |           |
| 7   | Soldering iron   | 14(14.8%) | 60(63.8%) | 14(14.8%) |           |
| 8   | Scissors         | 13(13.8%) | 70(74.5%) | 6(6.3%)   |           |
| 9   | Sewing machine   | 10(10.6%) | 20(21.2%) | 45(47.8%) |           |
| 10  | Markers          | 19(20.2%) | 75(79.7%) |           |           |
| 11  | Cardboard papers | 21(22.3%) | 73(79.7%) |           |           |
| 12  | Needle           | 10(10.6%) | 55(58.5%) | 23924.4%) |           |
| 13  | Projector        | 19(20.2%) | 75(79.7%) |           |           |
| 14  | Robotics         | 4(4.3%)   | 15(16%)   | 40(42.5%) | 10(10.6%) |
| 15  | Cooperate shoes  | 6(16.7%)  | 10(10.6%) | 51(54.2%) | 15(15.9%) |

Table1 shows the constituent of makerspace in academic libraries. It revealed that, library space had 12(12.7%) strongly agree, 82(87.2%) agree. 3D printer had 4(4.2%) strongly agree, 80(85.1%) agree and 10(10.6%) disagree. 3D scanner had 16(17%) strongly agree, 70(74.4%) agree and 8(8.5%) disagree. Software had 9(9.5%) strongly agree, 84(89.3%) agree and 1(1%) disagree. Computers had 30(31.9%) strongly agree and 74(78.7%) agree. Furniture had 14(14.8%) strongly agree, 80(85.1%) agree and 1(1%) disagree. Soldering iron had 14(14.8%) strongly agree, 60(63.8%) agree and 14(14.8%) decide. Scissors had 13(13.8%) strongly agree, 70(74.5%) agree and 6(6.3%). Sewing machines had 10(10.6%) strongly agree, 20(21.2%) agree and 45(47.8%) disagree . markers had 19(22.3%) strongly agree and 75(79.7%) agree. Cardboard papers had 21(22.3%) strongly agree and 73(77.6%) agree. Needle had 10(10.6%) strongly agree, 55(58.5%) agree

**Research Question Two;** What is the level of awareness of makerspace by academic libraries in Edo State?

Table 2: Level of awareness of makerspace by academic libraries.

| S/N | Items   | VHL        | HL        | LL        | VLL |
|-----|---|------------|-----------|-----------|-----|
| 1   | Provides a space for users to discuss ideas and collaborative work in the library | 7(7.4%)    | 63(67%)   | 24(25.5%) |     |
| 2   | Makersspaces enable student and faculty to apply sclentltic principle             | 10(10.6%)  | 70(74.5%) | 8(8.5%)   |     |
| 3   | Makerspace may include three dimensional gadgets like robots                      | 11(11.7%)  | 75(79.7%) | 8(8.5%)   |     |
| 4   | Makerspace is a Space created in the library to support library activities        | 9(9.5%)    | 69(73.4%) | 9(9.5%)   |     |
| 5   | Makerspace is a physical location embedded to share resources and knowledge.      | 8(8.5%)    | 72(76.5%) | 14(14.8%) |     |
| 6   | Markerspeace is a place that helps to cultivate creative imagination.             | 12(12.7%)  | 70(74.4%) | 4(4.4%)   |     |
| 7   | Markerspace is a mindset of community partnerships and collaboration.             | 11(1 1.7%) | 79(84%)   | 4(4.2%)   |     |

| 8 | Makersspace provides an opportunity for libraries to future-proof themselves and adapt to meet the changing nature of society | 6(6.3%) | 78(82.9%) | 10(10.6%) |
|---|---|---------|-----------|-----------|
| 9 | Makerspace provides<br>access to equipment for<br>prototyping project ideas<br>for companies                                  | 9(9.5%) | 66(70.2%) | 19(20.2%) |

Table 2 shows the level of awareness of makerspace by academic libraries in Edo State.

The findings revealed that, makerepacc provides a space for users to discuss ideas and collaborative work in the library had 70.4%) strongly agree, 63(67%) agree, 24(25.5%) disagree. Makerspaces enable student and faculty to apply scientific principle had 10(10.6%) strongly agree, 70(74.4%) agree and 12(12.7%). Markerspace may include three dimensional gadgets like robots had "(11.7%) strongly agree, 75(79.7%) agree and 8(8.5%) disagree. Makerspace is a space created in the library to support library activities had 9(9.5%) strongly agree, 69(73.4%) agree and 9(9.5%) disagree. Makerspace is a physical location embedded to share resources and knowledge had 8(8.5%) strongly agree, 72(76.5%) agree and 14(14.8%) disagree. Makerspace is a place that helps to cultivate creative imagination had 120.7%) strongly agree, 70(74.4%) agree and 4(4.4%) disagree. Had makerspace is a mindset of community partnerships and collaboration had 11(11.7%) strongly agree, 79(84%) agree and 4(84.2° 0) disagree. Makerspace provides an opportunity for libraries to future-proof themselves and adapt to meet the changing nature of society had 6(6.3%) strongly agree, 78(82.9%) agree and 10(10.6%) disagree and makerspace provides access to equipment for prototyping project ideas for companies had 9(9.5%) strongly agree, 66(70.2%) agree and 19(20.2%) disagree

**Research question 3:** What are the benefits of makerspace to academic libraries in Edo State? **Table 3:** The Perceived benefits of makerspace to academic libraries.

| S/N | SITEMS   | SA         | A         | D       | SD |
|-----|--|------------|-----------|---------|----|
| 1   | Provides access to a wide variety  | 14( 14.8%) | 78(82.9%) | 2(2.1%) |    |
|     | of tools and technology  |            |           |         |    |
| 2   | Facilitates group interaction  | 15(15.9%)  | 79(84%)   |         |    |
| 3   | Encourages access to physical space for individual project development   | 20(10.6%)  | 84(89.3%) |         |    |
| 4   | Provide an open environment for expression of creativity and innovation  | 3(2.1%)    | 92(97.8%) |         |    |
| 5   | 5 Access to equipment for prototyping project ideas for companies  | 12(12.7%)  | 77(81.9%) |         |    |
| 6   | provide an opportunity for libraries to future-proof themselves and adapt to meet the changing nature of society | 16(17%)    | 76(80.8%) |         |    |
| 7   | It improves knowledge  | 17(18%)    | 75(79.7%) |         |    |

Table 3 shows the benefits of makerspace to academic libraries. From the result is shows that makerspace provides access to a wide variety of tools and technology had 14(14.8%) strongly agree, 78(82.9%) agree and 2(2.1%) disagree. Facilitates group interaction had 15(15.9%) strongly agree and 79(84%) agree. Encourages access to physical space for individual project development had 20(10.6%) strongly agree and 84(89.3%) agree. Provide an open environment for expression of creativity and innovation had 3(2.1%) strongly agree and 92(97.8%) agree. Access to equipment for prototyping project ideas for companies had 12(12.7%) strongly agree 77(81.9%) agree. Provide an opportunity for libraries to future proof themselves and adapt to meet the changing nature of society had 16(17%) strongly agree and 76(80.8%) agree and it improves knowledge 17(18%) strongly agree and 75(79.7%) agree.

**Research question 4**: What are the challenges that could be encountered in the adoption of makerspace in academic libraries.

| S/N | ITEMS                  |    | SA        | A         | D | SD |
|-----|------------------------|----|-----------|-----------|---|----|
| 1   | Training               | of | 20(21.2%) | 69(73.4%) |   |    |
|     | academic library staff |    |           |           |   |    |

| 2 | Security of               | 20(21.2%) | 74(78.7%) |  |
|---|---------------------------|-----------|-----------|--|
|   | makerspace gadgets        |           |           |  |
| 4 | Poor funding              | 26(27.6%) | 68(70.8%) |  |
| 4 | Lack of sufficient        | 25(26.5%) | 68(70.8%) |  |
|   | space in the library      |           |           |  |
|   | building                  |           |           |  |
| 5 | Erratic power             | 21(22.3%) | 73(77.6%) |  |
|   | supply                    |           |           |  |
| 6 | Technophobia (fear        | 25(26.5%) | 69(73.3%) |  |
|   | of using technology)      |           |           |  |
| 7 | High cost and             | 27(28.7%) | 67(71.2%) |  |
|   | maintenance of equipment. |           |           |  |

Table 4 shows the challenges that could be encountered in the adoption of makerspace in academic libraries. From the result it indicated that training of academic library staff 20(21.2%) strongly agree and 69(73.4%) agree. Security of makerspace gadgets 20(21.2%) strongly agree 74(78.7%) agree. Poor funding had 26(27.6%) strongly agree 68(70.8°/o) agree. Lack of sufficient space in the library building had 25(26.5%) strongly agree and 08(70.8%) agree. Erratic power supply had 21(12.3%) strongly agree 73(77.6%) agree. Technophobia (fear of using technology) had 250.65%) strongly agree 69(73.3%) agree. High cost and maintenance of equipment had 27(28.7%) strongly agree and 67(71.2%) agree

## 4.4 Discussion of Findings

The study investigated makerspaces in Nigerian academic libraries: perceived benefits and challenges. The analysis generated in research question one, what constitutes makerspace in academic libraries, it was discovered that majority of the respondents agreed that library space, 3D printer, 3D scanner, software, computer(s), furniture, soldering iron, scissors, markers, cardboard papers, needle and projector. While some respondents disagree with sewing machines, robotics and cooperate shoes. Fernandez, (2014) opined that makerspaces may include 3D printers to produce three dimensional products such as toys and robots, tools for welding or building, software for the production of music as well as craft and art supplies. According to Hussain and Nisha (2017), maker-space is physical space in the library founded to allow information, knowledge, and experience sharing, and it hosts different people that have different backgrounds academically, and socially.

In response to research question two; level of awareness of makerspace by academic libraries. In Table 4.3.2. majority of the respondent at a high level of awareness of makerspace that it, provides a space for users to discuss ideas and collaborative work in the library, makerspaces enable student and faculty to apply scientific principle, makerspace may include three dimensional gadgets like robots, makerspace is a space created in the library to support library activities, makerspace is a physical location embedded to share resources and knowledge, makerspace is a place that helps to cultivate creative imagination, makerspace is a mindset of community partnerships and collaboration, makerspace provides an opportunity for libraries to future-proof themselves and adapt to meet the changing nature of society and makerspace provides access to equipment for prototyping project ideas for companies. This findings could be supported by the findings of Chan and Spodick (2014) attested that 'most of these early makerspaces are in public libraries'. This is also evident in the web-based survey whereby 51% of respondents were in public libraries, 36% in academic libraries, and 9% were in school libraries. Nevertheless, it has become a recent development in academic libraries as well. Okpala (2016) has highlighted the concept of makerspaces and its apparent benefits in academic libraries in Nigeria. The findings of the Study display that users attention is drawing towards library for fostering creativity and invention. Balas (2012) and Britton (2012), cited in Pryor (2014) remarked that makerspaces in libraries are definitely a trending topic in library discussion and literature, but much of the attention in this area has focused on public libraries. In the same vein, Boyle, et al (2014) added that 'the establishment of creative spaces (any place where the community can com le together for informal and shared social learning) in public libraries has been an emerging trend worldwide in recent years'.

Also, analysis of research question 3 showed the benefit of makerspace to academic libraries, the findings revealed that majority of the respondents agreed that makerspace Provides access to a wide variety of tools and technology, Facilitates group interaction, Encourages access to physical space for individual project development, Provide an open environment for expression of creativity and innovation, access to equipment for prototyping project ideas for companies, provide an opportunity for libraries to future-proof themselves and adapt to meet the changing nature of society and it improves knowledge. The findings is in line with the work of Abram (2013) who asserted that makerspaces are designed to meet the following needs: provide access to a wide variety of tools and technology; facilitate group interaction, knowledge, and resource sharing, supply access to Physical Space for individual project development, provide an open environment for expression of creativity and innovation and access to equipment for prototyping project ideas for companies.

Finally, the analysis which was showed in Table 4 point out the different challenges that could be encountered in the adoption of makerspace in academic. The Ending revealed the challenged faced which are; training of academic library staff, security of makerspace gadgets poor funding, lack of sufficient space in the library building, erratic power supply, technophobia (fear of using technology) and high cost and maintenance

of equipment. This could be supported by the findings of Harris and Cooper, (2015) that, it may take time before the users master the terminologies and intricacies of the makerspace. 3D technology in particular, is not an easy one to master; it may take longer time than expected for the users to master. Learning the ins and outs of 3D printers and other equipment takes a lot of time and patience. Nok, (2006) also find out that poor funding is a major challenge to libraries in Nigeria. Nigeria is yet to be named among the African countries that have celebrated one whole year of uninterrupted power supply as regular power generation remains a problem in Nigeria. Frequent power outages constitute a serious bottleneck to automation. The cost of running generating plants is prohibitive (Nok, 2006). Quite a lot of money is being invested in higher institutions to find alternative power supply. In a study conducted by Krubu and Osawaru (2011), it was ascertained that poor funding and erratic power supply are the major factors acting as a drawback or an impediment to the application of ICT in Nigerian University Libraries.

## 6. Summary

The major findings arising from this study are as follows:

- On what constitutes makerspace in academic libraries, it was discovered that majority of the respondents agreed that, library space, 3D printer, 3D scanner, software, computer(s), furniture, soldering iron, scissors, markers, cardboard papers, needle and projector. While some respondents disagree with sewing machines, robotics and cooperate shoes.
- In response to the level of awareness of makerspace by academic libraries, majority of the respondent at a high level of awareness of makerspace that it, provides a space for users to discuss ideas and collaborative work in the library, makerspaces enable student and faculty to apply scientific principle, makerspace may include three dimensional gadgets like robots, makerspace is a space created in the library to support library activities, makerspace is a physical location embedded to share resources and knowledge, makerspace is a place that helps to cultivate creative imagination, makerspace is a mindset of community partnerships and collaboration, makerspace provides an opportunity for libraries to future-proof themselves and adapt to meet the changing nature of society and Makerspace provides access to equipment for prototyping project ideas for companies.
- Also, on the benefit of makerspace to academic libraries, the findings revealed that majority of the respondents agreed that makerspace Provides access to a wide variety of tools and technology, Facilitates group interaction, Encourages access to physical space for individual project development, Provide an open environment for expression of creativity and innovation, access to equipment for prototyping project ideas for companies, provide an opportunity for libraries to future-proof themselves and adapt to meet the changing nature of society and it improves knowledge.
- Finally, the finding revealed the challenges faced which are; training of academic library staff, security of makerspace gadgets poor funding, lack of sufficient space in the library building, erratic power supply, technophobia (fear of using technology) and high cost and maintenance of equipment.

#### 7. Conclusion

Libraries of today are not just a place to sit quietly and consult books and other pedagogical materials but they have completely transformed into a spot where users can interact, create and collaborate. Makerspaces are the demand of modern libraries and expected to be a growing trend in the years to come. The idea of establishing makerspace in the library fosters creativity and invention.

# 8. Recommendations

in view of the foregoing, the following recommendations were made:

- I. Librarians should make stringent efforts to explore the potentials in makerspace in the enhancement of their services.
- II. Information practitioners should also explore how to use makerspace tools for digital
- III. Marketing of library services.
- IV. Academic libraries should make available enough bandwidth and a swift internet access to enhance the use of makerspace tools by librarians and information managers that work within the shores of information centers.
- V. An alternative power supply should be made available in academic libraries to enable
- VI. Librarians to charge their phones, laptops and other electronic gadgets which they to access web.
- VII. Training should be conducted regularly to enhance librarian's skills in the use of ICT and other tools for the boosting of library services.

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